DEPARTMENT OF MINES.

REPORT OF PROGRESS

OF THE

GEOLOGICAL SURVEY

OF

NEW SOUTH WALES.

BY

C. S. WILKINSON, F.G.S.,
GOVERNMENT GEOLOGIST.

WITH

DESCRIPTIVE NOTES ON THE TERTIARY FLORA OF NEW SOUTH WALES.

BY

BARON FERD. VON MÜELLER, C.M.G., M. & PH.D., F.R.S.

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Geological Survey of New South Wales,
22 August, 1876.

To the Honorable John Lucas, M.P., Minister for Mines.

Sir,

By your direction I have recently inspected several of the principal gold fields, for the purpose of reporting as to the necessity for the reservation of certain Crown Lands from alienation. In reference to this matter, I have already reported on some of the districts visited. But apart from the special object of my mission, the geology of the country traversed has also engaged my attention; and I now do myself the honor to give you some general remarks on the result of my observations—deferring the more detailed descriptions of the rocks for my annual report.

The geological formations observed have an important bearing upon the future prospects of the Gold Fields of New South Wales, for, not only do they afford evidence of the permanency of these fields, but they testify also to the existence of extensive auriferous deposits which have not yet been developed.

The diggings hitherto opened are of comparatively small extent, and yet, with but few localities excepted, nearly the whole of the country which I have examined, from Goulburn to Adelong and Wagga Wagga; thence through Young, Grenfell, Forbes, Parkes, and Wellington to Gulgong; thence again to Bathurst and Cowra, a distance of some 750 miles, together with most of the intervening country (which I have not examined, but from which specimens of the rocks have been received), embracing an area of about 18,000 square miles,—which is about one-third of the known auriferous country of New South Wales,—is occupied by auriferous formations.

A large extent of this country certainly has been prospected by the miner, and proved to be not payable, but in many instances the prospects have been such as to encourage the belief that with cheaper labour and more efficient appliances for extracting gold than are now in use, considerable tracts of auriferous ground now abandoned, will, at some future time, be profitably worked.

As an instance, I may mention the Old Lambing Flat Diggings around Young.

It is a remarkable fact, and one which was long ago pointed out by the Rev. W. B. Clarke, M.A., F.R.S., F.G.S., &c., that the hornblendic granites in this Colony are auriferous; and, with but few exceptions, I have noticed that on all the Gold Fields recently examined, hornblendic granites and intrusive greenstone or diorite are the original source whence the gold found in the alluvial deposits has been derived. At Grenfell this is very marked. Here we have a large mass of porphyrite intruding Upper Silurian schists. Quartz reefs varying in thickness from that of a mere thread to over 10 feet, traverse the intrusive rock in a north-easterly direction, and in some instances pass into the adjoining schists; but though richly auriferous while in the former rocks,

they cease to be so immediately on entering the schists. Such was the case in the "Consols" quartz reef, and these features are characteristic of the other reefs at Grenfell. Numerous reefs occur in the schists, but though a little gold was found in some, as yet none of them proved payable. But I think that amongst them some exceptions may be discovered when properly prospected; for the "Evening Star" reef, about 7 miles from Grenfell, is in the schist rocks and has yielded over half an ounce of gold to the ton. As a general rule, however, the reefs in these Upper Silurian strata are not payably auriferous, and this fact is further confirmed by the evidence afforded by the alluvial deposits or "leads."

At the Grenfell, Forbes, Parkes, Burrandong, and Gulgong Gold Diggings, the leads are payably auriferous where they pass over dykes of granite and diorite traversing the schists, and the yield of gold gradually falls off on leaving the dykes. It is owing to this that many of the leads have been found "patchy," or richer in some places than in others. Seeing therefore that the gold has been chiefly derived from these greenstone trap dykes, it is of importance that the attention of the miners should be drawn to the fact when they are searching for auriferous quartz reefs. At Adelong, payable quartz has been obtained from a reef at a depth of 530 feet. This reef is in granite associated with diorite. At Grenfell, the "Consols" mine is 716 feet deep, the deepest in the Colony. The reef, however, which was over 10 feet wide on the surface, yielding up to 3 ozs. to the ton, began to fail below 500 feet; it is expected, however, that it has made on the south-east side, and that by cross-cutting in that direction it will be again struck.

There is a large intrusive mass of greenstone about 1 mile west of Grenfell, which has not yet been prospected. I would recommend miners to test its auriferous character. At Burrandong, there are some shallow alluvial diggings now abandoned, but which which proved very rich*; here again is a mass of intrusive diorite and altered slates abounding in quartz reefs, which should comand the attention of the prospector. These slates differ in lithological character from the Upper Silurian schists abovementioned and greatly resemble the Lower Silurian slates of Victoria; but I could not detect any fossils in them to verify their age. The "Mitchell's Creek" reef near Wellington is in diorite; the reef is from 2 to 4 feet wide, and a recent crushing of 440 tons of quartz is said to have averaged about ½ oz. of gold to the ton. It contains sulphides of iron and copper. About 3 miles further to the north is "Fitty's" reef, also in diorite. In this promising reef, or rather reefs, for there are several of them, coarse specks of gold are sometimes found enclosed in green carbonate of copper. I believe that payable reefs occur in the line of greenstone formation which appears to have supplied the gold to the alluvial leads traversing the country between Forbes and Parkes; and from our inspection of the specimens of diorite lately collected by Mr. Warden Dalton from the country lying between the Lachlan and the Bogan, we can have little doubt but that there is a considerable tract of auriferous country yet to be developed extending for some 50 miles north-west from Parkes.

Quartz reefing in New South Wales may be considered in its infancy, and indeed the same remark will apply to alluvial mining; for hitherto the operations of the miners have been chiefly confined to the more shallow portions of the leads, which have been followed into the

* Note.—I am informed that 180 ounces of gold were obtained from one bucketful of a rich patch of wash-dirt.

deeper ground and there abandoned when the influx of water was too great for manual labour to cope with. On nearly all the alluvial diggings, as at Forbes, Parkes, Gulgong, and Grenfell, such has been the case ; and, doubtless, when once efficient machinery is introduced to work the wet ground in these localities, this class of gold-mining will soon become established on a permanent basis.

It is, of course, impossible to estimate the extent of such alluvial ground yet to be worked, but that it is very considerable I can confidently assert, from the geological evidence presented on our gold-fields. The auriferous alluvial leads or drifts are observed to belong to at least four distinct epochs ; those of the Upper Pliocene Tertiary formed the watercourses of a drainage system similar to that which now carries off the rain-water from the surface of the land. At that period the valleys were deeper than they now are, but owing to certain volcanic outbursts, molten lava flowed down into some of these valleys, burying in its course the river channels, and overwhelming the vegetation and animals that lived on the banks of those ancient streams. Climatic changes took place ; when the rocks and mountain slopes were disintegrated, and the denuded material—sand, mud, and pebbles—swept into the bottom of the valleys, still further filling them up with deposits, to be again eroded by unceasing atmospheric influences which have succeeded to our own day. Of all these we have abundant geological evidence. The strata passed through, as for instance in one single mining shaft at Gulgong, reveal for our perusal some of these pages in the book of Nature, which are beautifully illustrated by those* fossil leaves, fruit, and branches of large trees, and the fossil ferns which probably afforded shelter for the animals whose bones are also found entombed beneath that now solid lava which overwhelmed them. In the arrangement of the layers of the overlying sand, clay, and gravel, we see the effects of atmospheric forces the nature of which cannot be misunderstood. And thus from Earth's ancient history may be read lessons which the miner may make practical use of, if he will but avail himself of their valuable teaching to guide him in his search for the buried treasure.

Besides the auriferous resources of the districts above mentioned, extensive lodes of copper ores also occur. The recent rich discoveries at Coombing Park, Milbourne Creek, and near Borowa, confirm what was formerly anticipated from the surface indications. These, together with the Cow Flat, Wiseman's Creek, Carrangara, and other cupriferous localities in the Bathurst district, as well as the Goodrich, Belara, and the numerous occurrences of copper ores in the vicinity of Wellington, are indicative of the magnitude of the copper mining industry which these districts will at no distant day support.

In the Cudgegong and Macquarie River valleys there are considerable deposits of older Pliocene Tertiary drift. Apart from its stratigraphical position, its well-rounded water-worn character readily distinguishes it from the later Tertiary drifts. Wherever this older drift occurs, diamonds are found in some abundance. A company was once formed to mine for diamonds, and failed ; but its failure, like that of many gold-mining companies, may perhaps be attributed to other well-known causes than the absence of the precious gems or metals sought for. However,

* Note.—Remarkably fine specimens of these fossils, from a depth of 146 feet, in No. 23 Claim, Black Lead, at Gulgong, are now in the Museum of Mines.

diamonds are now frequently met with accidentally, in the process of washing for gold; and, doubtless, many more pass away unnoticed with the quartz pebbles, the specific gravity of which (2·6) is so near that of the diamond (3·5).

The result of my recent examination of this country has convinced me that its mineral wealth is practically inexhaustible; a large extent of the land is such as to offer every inducement to the agriculturalist; and the only requirement now is population and capital, to take advantage of these great resources.

I have the honor to be, Sir,

Your obedient Servant,

C. S. WILKINSON, F.G.S.,

Government Geologist.

GEOLOGICAL SURVEYOR'S REPORT.

REPORT OF PROGRESS OF THE GEOLOGICAL SURVEY, DURING THE YEAR 1875.

To The Under Secretary for Mines, &c., &c.

Sir,

I have the honor to submit, for your information, the following Report of Progress of the Geological Survey during the year 1875.

My appointment, which was held under the Minister for Lands, was transferred to the Department of the Minister for Mines on the 1st January, 1875. At that date, and until the end of March, I was engaged in the geological survey of Bowenfels, Hartley, Wallerawang, and Rydal Districts, embracing an area of about 160 square miles. Within this area are included all the coal mines at present worked in the Western Coal Fields, and the iron ore and limestone deposits of the Lithgow Valley Iron Company.

Mr. P. F. Adams, Surveyor General, from his extensive personal acquaintance with the geological features of the Colony, selected this locality for survey as one wherein might be worked out the geological connection between the Gold-bearing Silurian or Devonian Rocks and the overlying Coal Measures.

The necessity for this work I have referred to in my report on this district; suffice it to say here, that without an accurate knowledge of the nature and relative positions of the several formations, and this may be gained only by actual survey, it is impossible to obtain that definite and reliable information which is of value to science and for guidance in mining operations.

It was also considered that this part of the Western or Bowenfels District* deserved special attention, on account of its extensive mineral resources. For, being so favourably situated as it is for access by the Great Western Railway to and from the seaboard on the east, and the vast mineral and pastoral districts on the west, this district, we cannot doubt, will become one of considerable importance. By the extension of the railway into the gold and copper mining districts there will open an increasing demand for the coal, iron, and firebricks;

* Strictly speaking the term *western* is incorrectly applied to the Bowenfels district; for though on the western side of the Blue Mountains, this district is on the *eastern watershed*. The line of railway crosses the Dividing Range between Rydal and Wallerawang.

while the copper-smelting works at the coal mines will receive additional supplies of ore and regulus by the greater facilities of carriage thus afforded, and local enterprise will be stimulated.

The seams of coal are practically inexhaustible. Five collieries are now at work, the Bowenfels, Eskbank, Lithgow Valley, Vale of Clwydd, and Blackman's Flat Collieries. The first four of these are situated in proximity to each other in the Lithgow Valley; and the Great Western Railway runs through the midst of them. It is the lowest coal seam in the coal measures which is now worked in each colliery. The seam is from 8 to 11 feet thick, and in the Bowenfels and Lithgow Valley Collieries it is worked from its outcrop at the surface. It dips about 1 in 30 to the E. At the Eskbank and Vale of Clwydd Collieries, which are situated in that direction, the coal is worked from shafts; though at one part on the Eskbank Estate the seam also outcrops at the surface. The same seam of coal is worked at the Blackman's Flat Mine, on the Mudgee Road, some 9½ miles north-west from Lithgow Valley, and about 4 miles from the Wallerawang Railway Station. The coal is here 6 feet thick; but at Coal Creek, 2½ miles west on the Wallerawang Iron and Coal Company's Estate, it is 17 feet thick.

Professor Liversidge's report on the coal, giving analyses of samples from the mines, is herewith appended.

There are other seams of coal above that now being worked; one of these is from 15 feet thick, at Lithgow Valley, to over 30 feet thick, near the Marangaroo River, but it contains many clay-bands.

Interbedded with the coal measures are extensive beds of fire-clay, from which excellent firebricks are manufactured, and used at Eskbank, by the Lithgow Valley Iron Company, and at the Eskbank Copper Smelting Works.

The coal measures also contain four or five bands (from 2 to 18 inches thick) of clay ironstone, assaying up to 56 per cent. iron. This clayband ore is that at present so successfully smelted at the Lithgow Valley Iron Company's furnace, which was first charged on the 16th December. The constant working of our iron mines will indeed be a matter of congratulation to the Colony.

Several miles from Wallerawang there is abundance of marble limestone of the purest quality. Samples of this marble which I obtained dress well and take an excellent polish. It occurs within easy access to the Railway and may be got in blocks of any required size.

My survey also extends to the New South Wales Shale and Oil Company's Mine in Hartley Vale, where I measured the seam of the best kerosene shale or petroleum oil coal 3 feet 2 inches thick, besides nearly 2 feet of oil schist of poorer quality. The position of all these mineral deposits, together with descriptive notes, are shown on my map.

Many interesting and some new fossils, also rock specimens and minerals, were collected by myself and party.

By a section we measured from Mount Lambie to Mount Walker, the Devonian beds were ascertained to be not less than 10,000 feet thick. It is in the lower beds of this series that the magnetic iron and brown hæmatite deposits occur near Mount Lambie.

It is unnecessary for me however to enter into particulars in this progress report, they will be found in the report accompanying my map.

My examination of the district was commenced in the previous October, but owing to the inaccuracy of the only maps obtainable, and the consequent necessity of making traverse surveys, the progress of my work was much retarded. It is not that topographical surveys have not been made, but that the manner in which some of the old surveys were carried out in this rough mountainous country has precluded the possibility of compiling a map to represent the surveys as they exist on the ground. And this state of things must continue and be an ever-increasing source of annoyance and expense, both to the surveyor and the Government, until a trigonometrical survey be made the base of survey operations. The present rapid occupation and alienation of Crown Lands urgently requires that the trigonometrical survey of the Colony should be carried out as expeditiously as possible.

On the 12th of January I accompanied the Surveyor General and Mr. J. S. Farnell, M.L.A., then Minister for Lands, to Mount Lambie for the purpose of examining the summit as to its suitability for a trigonometrical station. This conspicuous hill, which was formerly cleared for the trigonometrical survey by the late Sir Thomas Mitchell, we found to be about 4,070 feet above sea level; from its commanding position it will form a very important station for observation.

On the following day, accompanied by the Rev. W. B. Clarke, M.A., and the Hon. Francis Lord, we inspected the iron and coal deposits, the survey of which was then being proceeded with. I may state that these gentlemen expressed their appreciation of the work I was engaged on.

During the progress of this survey 13,882 chains or 173½ miles of traverse were measured by myself and assistants—chiefly in defining the geological boundaries and the outcrop of the workable coal seams, and to fix the position of the limestone and iron ore deposits.

The heights of the principal hills have been ascertained by aneroid observations.

Over 1,250 specimens illustrative of the geology and mineral resources of the district were collected and forwarded to the Museum of the Department of Mines. Many of the fossil specimens are the finest yet discovered, and amongst them are several species believed to be new to science. Some of these, through the kindness of the Rev. W. B. Clarke, have been sent to Dr. Oldham, Director General of the Geological Survey of India, for examination by the Palæontologist of the Indian Survey, whose report on them I expect shortly to receive. Having completed the geological survey of this district, on the 2nd March I returned to Sydney. The preparation of my map was a work of considerable time, occupying almost as many months as it should have done weeks, owing to the inaccurate surveys before referred to, and the necessity of examining at the Surveyor General's Office nearly all the original plans of these surveys, from which I found it was impossible to make a correct compilation; but with the information afforded by my own traverse surveys I have, after much difficulty, compiled as accurate a map as I think it possible to make under the circumstances. The map is now in the hands of the lithographer, who has nearly completed his work.

From the Museum of the Department of Mines I assorted a collection of mineral ores and fossils characteristic of the geological formations of New South Wales for exposition at the last Annual Exhibition of the Agricultural Society, which opened on the 6th April, 1875. This collection comprised upwards of 1,000 specimens, brought together chiefly by the officers of the Mining Department, and supplemented by a few contributions from private sources, to which reference is made in my notes on the mineral exhibits published in the volume "*Mines and Mineral Statistics.*" For this collection the Department of Mines was awarded the first prize.

On 14th April, I visited Mount Wilson in company with Mr. R. D. Fitzgerald, the Deputy Surveyor General, and Mr. Moore, the Director of the Botanic Gardens, who made an official inspection of the country about Mount Wilson for the purpose of determining the boundaries of a reserve for timber. We found that the rich soil which, at this high point in the Blue Mountains, supports such a luxuriant growth of vegetation, has resulted from the decomposition of basaltic trap, which has here burst through the *Upper Coal Measures* and *Hawkesbury Sandstones*, and in parts has overflowed them. This basalt appears to be of Upper Tertiary age, and is probably contemporaneous with some of the extensive basalt flows in the Western District. It contains abundance of *oligoclase* or *glassy felspar*.

On the 14th May, I proceeded to examine the coal lands in the vicinity of Jamberoo and Kiama, the result of my examination has been already communicated to you in a special report.

When at Kiama I inspected the excavations then being made for the new docks. The rock excavated is a hard dense basalt which, on the west side of the harbour, is seen to pass under the *Lower Marine Coal Measures.* The lower beds of the coal measures consist of conglomerates containing pebbles and boulders derived from this basaltic trap, which is therefore older than the overlying sedimentary strata.

A short distance from the docks is the so-called "*Blow-hole*," which consists of a cavernous passage, 20 feet wide, 25 feet high, and 120 feet long, opening to the ocean at one (the eastern) end, and at the other by a funnel-shaped vertical pit. During an easterly gale the waves rush with great force up this passage and then being suddenly arrested at the end of it, the water is forced up the pit and spouted to a considerable height into the air. This "Blow-hole" has been formed by the action of the waves disintegrating and excavating a narrow dyke of basalt which traverses, in a direction N. 20° W., the older columnar basalt; the latter being of a hard nature has resisted the action of the water, while the softer dyke has been washed away.

The vicinity of Kiama has special interest for the geologist. On the west shore of the harbour we have the carboniferous marine beds resting on the older basalt; and in the bold cliffs facing the ocean are seen splendid sections showing several dykes of a newer trap cutting through both the older basalt and the carboniferous marine strata. The dyke at the "Blow-hole" is one of these dykes.

They probably indicate the "*pipes*" whence issued in a molten state the porphyritic trap which overlies the carboniferous beds. This trap attains a thickness of from 150 to 200 feet, and its well-defined columnar structure is grandly shown in the coast cliffs about 2 miles north

from Kiama* ; its black vertical columns stand in marked contrast with the lighter coloured nearly horizontal strata underneath. This upper basalt varies very much in its lithological character ; in places it passes into greenstone, felspar porphyry, amygdaloid, and sometimes into an almost pure siliceous rock resembling quartzite, but with crystals of felspar distinctly traceable in it.

Immediately overlying this porphyritic basalt are the Upper Coal Measures with their extensive seams of coal—the equivalents of the seams now being worked at Bulli, Mount Pleasant, and Mount Keira near Wollongong.

The Upper Coal Measures in the Jamberoo District are from 500 to 800 feet thick, and are overlaid by the Hawkesbury Rocks from 200 to 400 feet in thickness, which between Jamberoo and Broughton Vale form a table-topped range called the " Saddle-back Mountain," having an undulating surface about 2,000 feet above sea-level. From this range to the coast, we have thus presented to us an interesting geological section, showing in descending order the following formations :—

Hawkesbury Rocks.
Upper Coal Measures.
Porphyritic Basalt, Greenstone, &c.
Coal Measures. (Marine Beds).
Basaltic trap.

During August and September I was prevented from active work by a severe attack of bronchitis. But for this illness, I was about to undertake, as you directed, a geological examination of the Lachlan District, for the purpose, among others, of getting further information as to the direction and extension to the westward of the auriferous deep leads, and also of reporting on certain of the Reserves for Gold Fields as to the advisability of their cancellation or continued reservation.

This work I hope shortly to undertake, now that the collection of exhibits for the Philadelphia Exhibition is nearly completed. The geological and mineralogical collection to be exhibited by the Department of Mines will include 748 *labelled samples*, of which eight samples consist of coal; the remainder of other minerals and fossils, numbering altogether about 900 specimens. The geological section of the collection will have special scientific interest, inasmuch as it will exhibit the chief of the characteristic fossils of the principal sedimentary formations; and the mineral section cannot fail to impress the visitors at the Philadelphia Exhibition with the magnitude of the coal and other mineral resources of New South Wales. The greater part of this collection was lately arranged and exhibited at the Temperance Hall, Sydney, to afford the public an opportunity of inspecting the exhibits previous to their transmission to America.

The following table gives a statement of the value per ounce, description, and assays of the *gold* exhibits sent. The gold, consisting of 46 samples of about 2 ounces each, from various Gold Fields in the Northern, Southern, and Western districts of the Colony, was selected and assayed at the Royal Mint, Sydney.

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* Note.—The illustration of *Basaltic columns, Coast of Illawarra, New South Wales*, in Dana's *Manual of Geology, p.* 108, is a sketch from one of these cliffs.

Samples of Gold characteristic of the Gold Fields of New South Wales.

No.	Locality.	Description of Gold.	Weight of Sample.	Loss in Melting, ₱ cent.	Gold and Silver in 1,000 parts, afrer Melting.		Value per Oz. after melting, at £3 17s. 10½d. Standard.		
	Western District.		Ozs.		Gold.	Silver.	£	s.	d.
692	Sofala	In fine scales, and coarse plates and grains	2·50	1·54	923·0	72	3	18	9½
693	Bathurst	Fine scales and coarse grains, with some spongy and stringy	2·00	2·00	923·5	71	3	18	10
694	Do.	Fine scales, plates, and coarse grains	2·00	1·47	918·0	76	3	18	4½
695	Hargraves	Fine dust and coarse grains	2·00	2·23	920·5	70	3	18	6½
696	Do.	Scaly, with some grains	2·00	1·15	961·0	33	4	1	9½
697	Tambaroora	Fine and coarse, scaly, and grains	2·00	1·31	940·0	54	4	0	1
698	Do.	Fine scales and grains	2·00	1·55	943·5	50	4	0	5
699	Do.	Reef gold, reticulated	2·00	2·77	944·5	51	4	0	6
700	Do.	Coarse waterworn grains or nuggets	2·53	2·00	935·5	54	3	19	8½
701	Hill End	Fine dust and coarse grains	2·00	2·47	945·5	47	4	0	7
702	Do.	Scaly, with coarse spongy grains	2·00	1·41	945·5	50	4	0	7
703	Do.	Fine scales, and coarse crystalline gold	2·00	2·18	947·0	47	4	0	8½
704	Do.	Scaly, and coarse filiform gold	2·00	1·97	942·5	49	4	0	4
705	Mudgee	Fine scales and coarse grains	2·50	1·93	941·0	56	4	0	2½
706	Do.	Coarse grains, with some scales	2·00	2·04	926·0	68	3	19	0
707	Do.	Fine and coarse scales	2·00	1·77	937·0	58	3	19	10½
708	Gulgong	Coarse spongy grains and some scales	2·00	1·78	938·0	58	3	19	11½
709	Do.	Dust and coarse scales	2·00	1·78	916·5	79	3	18	3
710	Do.	Coarse pieces, filiform and spongy	2·00	1·78	925·0	70	3	18	11
711	Do.	Scaly, with some grains	2·00	1·59	946·0	48	4	0	7½
712	Carcoar	Fine scales, very porous, with some magnetic iron	2·00	10·92	878·0	119	3	15	2
713	Do.	Fine and coarse filiform gold of a dark colour	2·00	2·94	960·0	36	4	1	8½
714	Orange	Scaly	2·00	2·67	943·0	51	4	0	4½
715	Do.	Fine dust—"Gunpowder gold"	2·00	2·53	930·5	62	3	19	4
716	Stony Creek	Scaly	2·00	1·56	942·0	54	4	0	3½
	Southern District.								
717	Braidwood	Plates and fine scaly	2·00	1·79	959·0	34	4	1	7½
718	Araluen	Fine dust—"Gunpowder gold"	2·00	2·19	951·5	42	4	1	0½
719	Adelong	Fine scaly and coarse filiform	2·00	2·63	944·0	52	4	0	5½
720	Do.	Scaly	2·00	1·27	941·0	53	4	0	2
721	Do.	Coarse filiform with some scaly	2·50	1·69	946·0	50	4	0	7½
722	Tumut	Fine and coarse, some very spongy	2·00	6·28	927·5	70	3	19	1½
723	Young	Scaly dust gold	2·00	2·39	957·0	36	4	1	5½
724	Do.	Fine dust—"Gunpowder gold"	2·00	1·52	943·0	49	4	0	4½
725	Nerrigundah	Strings, scales, and plates	2·50	1·64	980·5	15	4	3	4½
726	Kiandra	Scales and plates, with some grains and threads	2·00	3·15	927·0	63	3	19	1
727	Goulburn	Coarse grains and reticulated	2·00	6·87	975·0	22	4	2	11½
728	Bombala	Very fine scaly dust—"Gunpowder gold"	2·00	2·63	963·0	34	4	1	11½
729	Cooma	Filiform, crystalline, and some scaly	2	3·17	938·0	56	3	19	11½
730	Do.	Filiform, crystalline, and some scaly	2·00	4·22	924·0	70	3	18	10
	Northern District.								
731	Nundle	Fine scaly and coarse filiform	2·00	3·33	919·5	73	3	18	6
732	Do.	Scales, plates, and coarse filiform, of a brownish colour	2·00	3·28	902·5	90	3	17	1½
733	Tamworth	Spongy, filiform, and crystalline; some with a little quartz attached	2·00	3·28	912·0	83	3	17	10½
734	Do.	Do. do. do do.	2·00	3·31	914·0	80	3	18	0½
735	Do.	Fine dust and shotty grains	2·00	3·31	899·5	93	3	16	10½
736	Armidale	Scales, with some threads	2·00	3·30	948·0	44	4	0	9
737	Do.	Fine scales	2·00	1·91	888·5	105	3	16	0

The results of the above assays are interesting and important, as maintaining the statement of Professor J. D. Dana that "the average proportion of gold in the native gold of California, as derived from assays of several hundred millions of dollars worth, is 880 thousandths; while the range is mostly between 870 and 890 (Prof. J. C. Booth, of U. S. Mint, in a letter to the author, of May, 1867). The range in the metal of Australia is mostly between 909 and 960, with an average of 925." Our present assays show even a higher average of 935·5.

It will also be seen from the tables that the value per ounce ranges from £3 15s. 2d. up to as high as £4 3s. 4½d.; no less than twenty-four of the samples being over £4, and eighteen over £3 17s. 10d. per ounce; the average value per ounce of the forty-six samples being £3 19s. 9d.

I have also been engaged with arrangement of the new Mining and Geological Museum of the Department of Mines, but the delay in obtaining the requisite cases and fittings, together with the preparations for the Philadelphia Exhibition, have hitherto prevented me from getting the minerals and fossils classified. The cases are now being fitted up, so that we hope very shortly to have all arrangements completed. When this is done, our present collection will form the nucleus of one from which may be derived reliable information respecting the mineralogy and geology of the Colony.

Upwards of 2,500 specimens have already been brought together by the Geological Survey party, the Examiner of Coal Fields, the Wardens, Mining Registrars, and other officers of the Department, whom you have instructed to forward specimens from their several districts. Amongst others received is a valuable collection of tin ores sent by Mr. Gower, Mining Registrar, which contains a remarkably fine specimen of stanniferous wash from the Vegetable Creek Tin Mine (O'Daly's); also some fossil leaves, indicative of the *Miocene Period*, from the clays and gravels of the tin-bearing beds of New England. Mr. Warden Dalton has sent some rich samples of auriferous wash-dirt from the deep leads in the Parkes district. Mr. Warden De Boos has forwarded specimens of auriferous quartz, illustrative of some of the reefs in the Southern district. Contributions of specimens to the Department of Mines have also been received from private sources. The following is a list of the contributors:—

Messrs. Beilby & Scott	Specimen of lode tin in granite, from the Bolitho Tin Mine.
Mr. Quong Tart	Samples of Quartz, with gold, from Lady Belmore Line of Reef, Braidwood.
Mr. Thomas Carpenter, C.E.	Crystallized and Grain Tin, and Tin Slag, from the Pyrmont Tin Smelting Works, Sydney.
Mr. J. M. Butchart	Specimens of Cassiterite (Wood-tin), from the Gulf, Beardy Falls.
Mr. Rees	Carbonates of Copper from Copabella, Southern District; Impure Graphite from same locality; and Antimony from Wallerawang.
Mr. J. Chiplin	Green Carbonate, Grey and Yellow Sulphides of Copper from 3-mile Flat, 4 miles north of Wellington; also samples of Pyritous Quartz from Mitchell's Creek, County of Lincoln.
Mr. John Deer	Green and blue Carbonates, yellow Sulphide, and red Oxide of Copper, from Frog's-hole, Parish of Bala, County of King.
Mr. W. Bryant.....	Carbonates and Sulphides of Copper, with Galena, from the Cow Flat Copper Mine, near Bathurst.

Mr. C. R. Darton	Samples of native or virgin Copper, grey and yellow Sulphide, green and blue Carbonates, and red and black Oxides of Copper, assaying from 25 to 40·4 per cent. Copper, from the Belara Copper Mine, 20 miles from Gulgong.
Mr. Thos. Taylor	Green and blue Carbonates of Copper, red Oxide and Native Copper, and yellow Sulphides of Copper, from Peelwood, 10 miles from Tuena.
Mr. Gustavus Lett	Yellow Sulphide and green and blue Carbonates of Copper, from Mitchell's Creek, County of Lincoln.
The Hon. Francis Lord, M.L.C.	Specimen of Nickel Ore, Noumeïte, from New Caledonia.
Mr. Alderman J. R. Steel	Specimen of Nickel Ore, Garnierite, from New Caledonia.
The Hon. John Lucas, M.L.A., Minister for Mines	Specimens of Antimony from Pyramul; Calcite, from Fish River Caves; Stalactite, from Fish River Caves; also Lower Marine Coal Measures Fossils from Wollongong; Cinnabar from Cudgegong; and Limonite from Lithgow Valley.
Mr. J. B. North	Copper Ores from Belara, and Kerosene Shale from Joadja Creek, Berrima
Messrs. Gilchrist & Weston	Sulphides of Copper from the Ophir Copper Mine.
Mr. J. De V. Lamb & Mr. J. Brown	Kerosene Shale from their property at Joadja, near Berrima.
Dr. Morgan	Gold in slate, from "Sandstone Reef," Cowarbee.
Mr. W. B. Simpson, L.S.	Carbonates of Copper from the Wellington District, and Silurian Fossils from the same district.
Mr. C. O. Helm	Amononite showing section of Septa.
Mr. James Daw	Gold in quartz from Courts' 4-acre lease, Hawkin's Hill View.
Mr. W. O'Halloran	Opalised wood, from Bloomfield, near Orange.
Mr. Hagarty	Auriferous Quartz, from Hill End.
Mr. James Jackson	Asbestos, from Wentworth, Lucknow Goldfield.
Mr. Seymour C. Stewart, J.P.	Gold in quartz, from Adelong.
Mr. George Hulks	Talcose Schist, from near Bathurst.
Mr. L. E. Johnstone	Gold in quartz, from Crudine Creek.
Captain Armstrong, R.N.	Specimens of various Copper Ores—Carbonates, Sulphides, and Red Oxide, from the Armstrong Copper Mine; also Carbonates, Sulphides, and Red and Black Oxides of Copper, from South Wiseman's Creek Copper Mine, near Bathurst.
Mr. H. A. Thompson	Ingot of Copper, and some Metallic Copper extracted by Hunt and Douglass' new Process, and Sulphides of Copper from the Goodrich Copper Mine; also samples of Stream Tin from the Wylie and Ruby Creeks Tin Mines; and ingot of Tin smelted from the same ores at the St. Leonards Tin Smelting Works.
Mr. J. Nancarrow, Manager of J. Young's Steam Marble Works.	Tiles of polished Colonial Marbles, from Marulan and Cow Flat; also one tile of marble from Six Island, off coast of Queensland.
Lithgow Valley Iron Co.	A bar of Pig Iron, the produce of the first smelting at the Lithgow Valley Iron Company's new Works, at Eskbank.
Mr. R. D. Adams	Large specimens of Galena, from Mylora, near Yass.
Mr. James Jones	Sulphide and Carbonate of Copper, from Jones's Mount, Tuena.
Rev. W. B. Clarke, M.A., F.G.S., &c., Branthwaite, St. Leonards.	Devonian Fossils, Spirifer and Rhynchonella, from the Gulf, Turon River; broken Auriferous Granite, from the County of Clive; and Tertiary Auriferous Cement with Silicate of Iron, from Two-mile Flat, Cudgegong River.
Mr. John Hume, Forest Lodge	Devonian Fossils—Lepidodendron and Spirifer—from range 10 miles north of Goulburn.
Mr. Thomas Brown, M.L.A., Esk Bank	Five large samples of Coal, with a section taken from the Coal Seam worked in the Western District, showing its actual thickness of 10 ft. 6 in.; also various other minerals from Capertee, Castlereagh River, &c.
Mr. W. Macleay, F.L.S.	Samples of rocks, &c., from New Guinea and adjacent Islands, collected by Mr. W. Macleay during his recent expedition. These specimens are specially interesting, as being the first Marine Miocene Tertiary Fossils discovered north of Cape Howe, and of the existence of which this is the first notice given.

In accordance with your instructions I made up and dispatched, on the 23rd February, for M. Simon, Consul for France, a collection of fossil and mineral specimens for transmission to the School of Mines, Paris. This collection, though necessarily small owing to the recent establishment of the geological survey, yet contains some of the most characteristic fossils of the geological formations of New South Wales. It is proposed to supplement these with other contributions from time to time as the Museum of the Department will admit of it.

In February Mr. E. Farr, then Mining Registrar at Bathurst, forwarded to this department some specimens of fossil fruit, found at a depth of 110 feet under basalt at Beneree. These I at once submitted to Baron von Müeller, C.M.G., M.D., Ph. D., F.R.S., and L.S., Government Botanist of Victoria, &c., whose description of the Tertiary fossil plants, published by the Department of Mines, Victoria, has so largely added to our knowledge of Australian fossil botany. Baron von Müeller informed me that on examining our specimens he discovered a new genus of plant, which he has designated *Rhytidocaryon;* while the other fossils he identified as belonging to species already described from the *Pliocene* Tertiary deep leads of Victoria. The Baron also very kindly favoured me with a full diagnosis of our fossils, which is herewith appended, accompanied by lithograms from drawings admirably executed on stone by Mr. Arthur J. Stopps, of the Surveyor General's Department.

During the year, 119 samples of the more important metallic ores and coals from our Museum have been submitted to Professor Liversidge, University of Sydney, for analysis. These comprise sixteen samples of coal, characteristic of the seams of coal worked in the various coal fields of the Colony; twenty-four samples of copper ores; sixty-seven samples of auriferous and stanniferous tailings and waste products; besides samples of antimony ore, iron ore, auriferous quartz, &c. Professor Liversidge's report, I am informed, you will shortly receive.

I have, &c.,

C. S. WILKINSON.

APPENDIX.

DESCRIPTION OF FOSSIL PLANTS FROM THE UPPER TERTIARY AURIFEROUS DRIFTS OF NEW SOUTH WALES.

By Baron FERD. von MÜELLER, C.M.G., Ph.D., M.D., F.R.S., Government Botanist of Victoria.

RHYTIDOCARYON—F. von MÜELLER.

Fruit, spherical or slightly ovate, not distinctly dehiscent, one-seeded, with an oblique basal or slightly lateral attachment, woody or bony, externally wrinkled and somewhat tuberculate. Septum large, placenta-like, erect or slightly ascending from the bottom of the cavity, consisting of two portions, which are smooth, turged, oblique, ovate, or sometimes broadly clavate or roundish, always more or less contracted at the base, mutually connate at the middle, rounded at the edges, broadly adnate to the lateral parts of the cavity, free from its summit. Seed cylindrical, bent around the placental or septal protrusion, oblique orbicular or ovate hippocrepical in outline, with a marginal furrow. Testa, thin, brittle, smooth.

RHYTIDOCARYON WILKINSONII.—Plate I., Figs. 1, 2, 3.

Beneree, under basalt, at a depth of 110 feet; Mr. Edward Farr; communicated by Mr. C. S. Wilkinson. Found also between Carcoar and Orange, by the Rev. W. B. Clarke, M.A. Fruits, which constituted probably separate carpels of a tricoccous fructification from two-thirds to rather above 1 inch long, externally uneven from somewhat irregular slightly concentric ridges, which are often broken up into short tubercules, approaching in roughness somewhat to those of Phymatocaryon Mackayi, probably covered originally by a pulpy pericarp, which in decay would early perish, thus the nut-like covering constituting a putamen or endocarp; a very faint cleavage at the base, but no trace of valvular dehiscence; septal process from less than double to nearly triple the width of the walls of the endocarp, except the base and back free from the cavity. Seeds (in all specimens under examination) perished, but their form recognized from the space left for their reception between the dissepiment and the inner faces of the endocarp; remnants of the testa not showing any indications to intrusions into the albumen. The latter and the embryo unknown.

This new fossil, so far as I can judge from the material transmitted to me, brings before us for the first time with certainty a member of the Menispermeæ among the vegetation of by-gone creations, inasmuch as of this order hitherto only the altogether doubtful genus M'Clintockia (*Heer die Fossile der Polarländer*, 114–116; *Schimper, Traité de Paléontologie Végétale*, iii, 83–84, *pl.* xcviii) became palæontologically recorded. Unacquainted as we are with the flowers and the embryonic characters of the fruit, we must regard it unsafe to place this into any of the numerous genera of Menispermeæ, distinguished mainly by their floral organization and the inner structure of their fruit; but the endocarp and septal protuberance show some resemblance to the South Asiatic genera Hypserpa (Miers, in Annals of Natural History, sic. ser. vii, 40), Limacia, and Nephroica (*Laureiro Flora Cochinchinensis*, 620 *et* 692), and the East Australian Sarcopetalum (F. M., Plants indigenous to the Colony, Victoria I., 27, pl. iii, Suppl.) The putamen, however, is more rough than that of any of these genera, and indeed conspicuously thicker than that of any living menispermaceous plant known to me, while in its great size the fruit of Rhytidocaryon shows only similarity (and in this respect merely) to Hæmatocarpus (Miers's Contributions to Botany, iii, 324, t. 134). The leaves are unknown. It is probable that the plant yielding these fruits formed, like most of the menispermaceous order, a climbing shrub.

SPONDYLOSTROBUS—F. von MUELLER.

[Strobilus woody, globose ovate or almost spherical, with five, rarely four or six, thick longitudinal ribs, forming as many blunt prominent dissepiments, consolidated in the axis of the fruit; these costæ at the vertex furrowed by single grooves. Base of the strobilus naked. Valves, five, rarely four or six, interjacent to the costæ, and by them widely separated from each other, erect, long appressed, fixed at the base, compressed-trigonous, the exterior face in outline oblong or lanceolar-oval, all nearly equal in size, and extending from the base of the fruit to about three-fourths its height, irregularly rough at the back, not keeled nor appendiculate. Cells, five, rarely four or six, each bearing a single seed towards the centre of the fruit. Seed ovate, nearly half as long as the valves, very convex at the inner side, winged around the whole margin, pendant from near the apex of the cavity, to which it is affixed, not always all developed.

I derive the generic name from σπόνδυλος (verticillus, whorl) and στροβος (strobos, pine cone).]*

SPONDYLOSTROBUS SMYTHII.—Plate II., Figs. 1, 2, 3.

The fruits of this tree are rather variable in size and shape, but preserve throughout a long series of varieties, the cardinal characteristics of this extinct genus of Coniferæ, of which, as yet, but one species became known, described by me in Mr. R. Brough Smyth's "Reports of Mining Surveyors and Registrars for 1871." A short notice of this fossil appeared also in the "London Geologic Magazine" for March, 1871. We had this identical plant hitherto from Nintingbool, the Tangil, Beechworth, and also from Orange, in New South Wales, among pliocene drift. This tree must therefore have occupied a vast area of that period. As foliage of pine-like trees is preserved readily in a fossil state, we may succeed in discovering the leaves, and also get the flowers of this conifer, for which hitherto on other spots a search has been made in vain. This fossil, together with the *Penteune Clarkei*, is indicative of auriferous strata.

[The validity of the genus rests chiefly on the extraordinary development of the columella, if so it may be called; this columellar portion forming indeed the main body of the fruit. In this respect Spondylostrobus differs from all other cupressineous genera, living as well as by-gone. It shares the normally five-valved structure of the fruit only with Solenostrobus (Endlicher, Synopsis Coniferarum, page 272, Cupressinites; Bowerbank, London Clay, partly), but, as explained already in the diagnosis, this character of the number of valves is not absolute, though predominant, and thus vindicating the generic value of Solenostrobus. The species of the latter genus are, however, very distinct from Spondylostrobus, should even the augmentation of material from new sources induce us hereafter to unite generically the new fossil now reviewed with Solenostrobus. Access to Bowerbank's illustrated work ("History of the Fossil Fruits and Seeds of the London Clay, 1840"), obligingly afforded me by my venerable friend the Rev. W. B. Clarke, the senior of Australian philosophers, proved beyond doubt that the enormous columellar receptacle of Spondylostrobus, on which the valves are sunk, is totally wanting in any of the four species of Solenostrobus figured. (Plate IX, figs. 22 and 23; also plate X, figs. 24 and 25; also figs. 28 and 29). These illustrations indeed show sufficiently that the margins of the fruit-valves are contiguous, precisely as in the existing genus Callitris, and its sub-genera Frenela, Actinostrobus, and Octoclinis; whereas in Spondylostrobus the fruit valves are rent dered discontiguous by the intervening and protruding ridges of the receptacle. Excellent as Sowerby's drawings are, as furnished for Bowerbank's work, they give us no insight into the real inner structure of Solenostrobus, owing indeed to the scanty or imperfectly preserved material, not sufficient for examination, or too precious to be sacrificed in dissection. Another allied genus, Passalostrobus (Endl. Syn. Conif., 278; Cupressinites tesselatus, Bowerb., Lond. Clay, page 53, plate X, figs. 26, 27, 30, 31), may perhaps indicate, in its structure, an approach to a columnar development beyond the summit, but not beyond the margins of the valves, should the central portion of the fruit be receptacular and not valvular. This the re-inspection of the original specimens can only explain. The doubts entertained by the learned Schimper in reference to the systematic position of Solenostrobus

* The paragraphs in brackets are extracts from "Observations on New Vegetable Fossils of the Auriferous Drifts, by Baron Ferd. von Müeller, C.M.G., &c.," published by the Victoria Mining Department.

(Conf. Schimper Traité de Paléontologie Végétale, tome seconde, 1870, page 358), are, by the discovery of our pentamerous conifer in Australia, now completely cleared away. Neither in his work, nor in Heer's still more recent elucidation of some fossil coniferæ (Philos. Transactions of the Royal Society of London, 1870, page 463, plate XLI, figs. 10 and 11; also plate XLIII, figs. 4 and 5) are any additional plants recorded to shed light on the pentamerous coniferæ from Sheppy, as regards their foliage and seeds.

[In reference to the affinity of Spondylostrobus to existing coniferous plants, a comparison is possible only with Callitris and its sub-genera, because they alone exhibit likewise a simple verticillus of fruit valves. In all the species of that genus, the columella is comparatively small or obliterated, and therefore no obstacle offered to the contiguity of the fruit valves. The seeds, moreover, are never in number less than two located at each valve, often more in number, sometimes numerous, while the valves are four, six, or rarely eight in normal number, never five. Absence of flowers, leaves, and perfect seeds of Spondylostrobus prevent us from carrying the comparison further. There is no other genus, ecorded in the recent elaborate essay on existing coniferæ of the whole globe, as furnished by my illustrious friend, Professor Parlatore, for De Candolle's Prodromus (pars XVI, 361–521) that could be regarded closely related to the fossil plant here under consideration.]

PENTEUNE—F. von MÜELLER.

[Fruit five-valved to the base, ovate, globose, or broadly ovate; dehiscence loculicidal; valves exceedingly hick, woody, very slightly rough on the dorsal part. Cavity towards the middle part of the valves. Free central axis absent. Cells five in number. Seeds solitary in each cell, towards their summit attached to the inner angles of the valves, turgid, ovate or verging into an ellipsoid form, blunt at the base, more gradually attenuated upwards. Testa smooth.

[The generic name, composed of πεντε and ἐυνὴ, is chosen in allusion to the five valves on which the seeds are imbedded.]

No. 4 is the front of the Penteune Clarkei, also of this tree which was a companion of the Strongylostrobus, but seemingly less frequent than the latter, we have as yet neither flowers nor leaves.*

[In the absence of any other identified remnants of this doubtless arboreous plant, no positive systematic position can as yet be found for this genus. It belonged however most probably to Sapendaceæ, although the possibility of its having formed a genus of the Meliaceous order is not excluded.]

[This conspicuous fossil is dedicated to the Rev. W. B. Clarke, M.A., F.R.G.S., F.G.S., F.Z.S., the nestor among Australian workers in the field of natural science, who amidst the arduous duties of his ecclesiastic calling has carried on with unabating enthusiasm his geologic researches in this continent for nearly half a century.]

[An externally very similar fossil has been discovered in Tasmania, by Morton Alport, Esq., at Gerlston Bay, in tertiary travertin. Some affinity of these fossils to the genus Rhytidotheca is evident from the number of the valves, the dehiscence and the single seed in each cell.]

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* Fossils transmitted by the Rev. W. B. Clarke, along with Rhytidocaryon Wilkinsonii. Penteune Clarkei (variable in the size of its forms). Phymatocaryon angulare (with a bi-valved variety). In reference to Spondylostrobus Smythii may be added that it produces (though very rarely) a *tri-valved* variety.—F. v M.

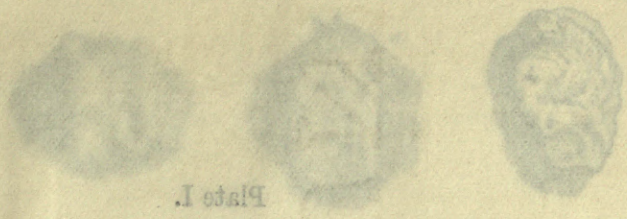

Plate I.

FIGS. 1, 2, 3, RHYTIDOCARYON WILKINSONII.

1 *a* Anterior view of fruit.

b Summit of fruit.

c Dorsal view.

Fig. 2 *a*, *b* Anterior and posterior views of larger fruit.

c Side view.

3 Interior view exhibiting cavity and condyle.

Fig. 3 *a*, *b* Interior of smaller variety of fruit showing cavity and condyles.

c Side view.

d, *e* Anterior and posterior views.

Figures drawn according to natural dimensions.

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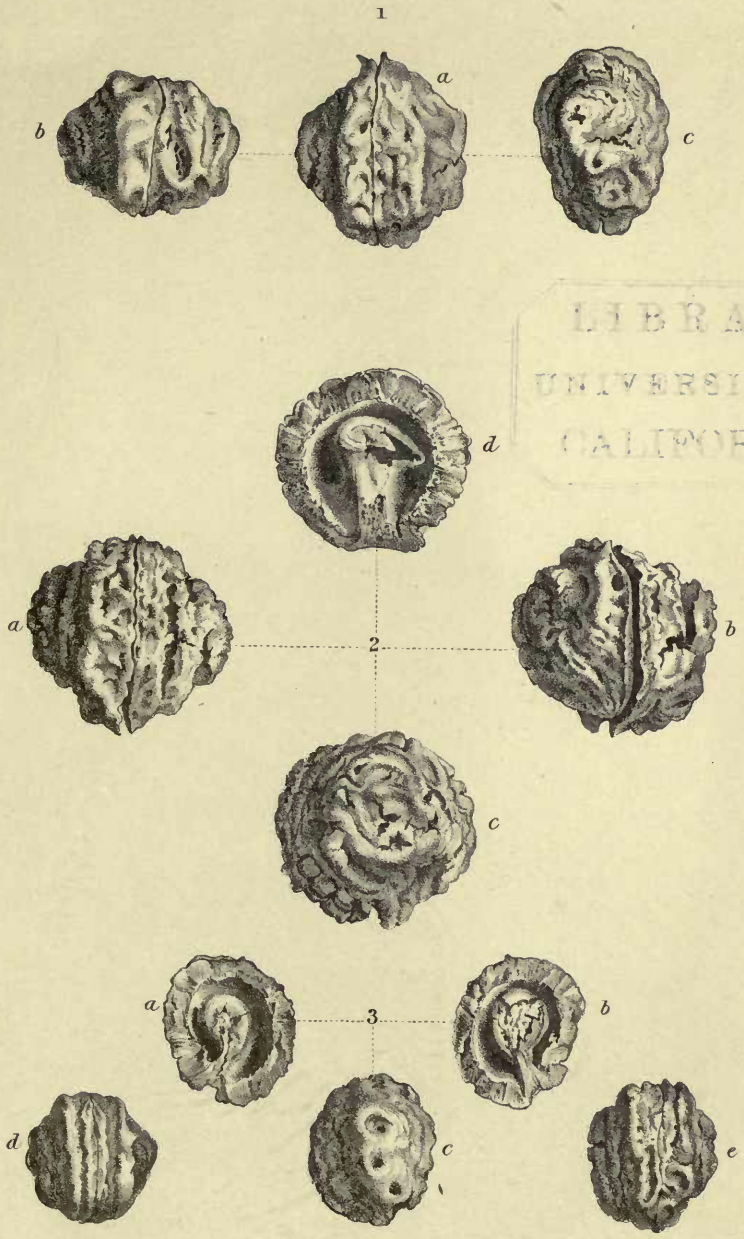

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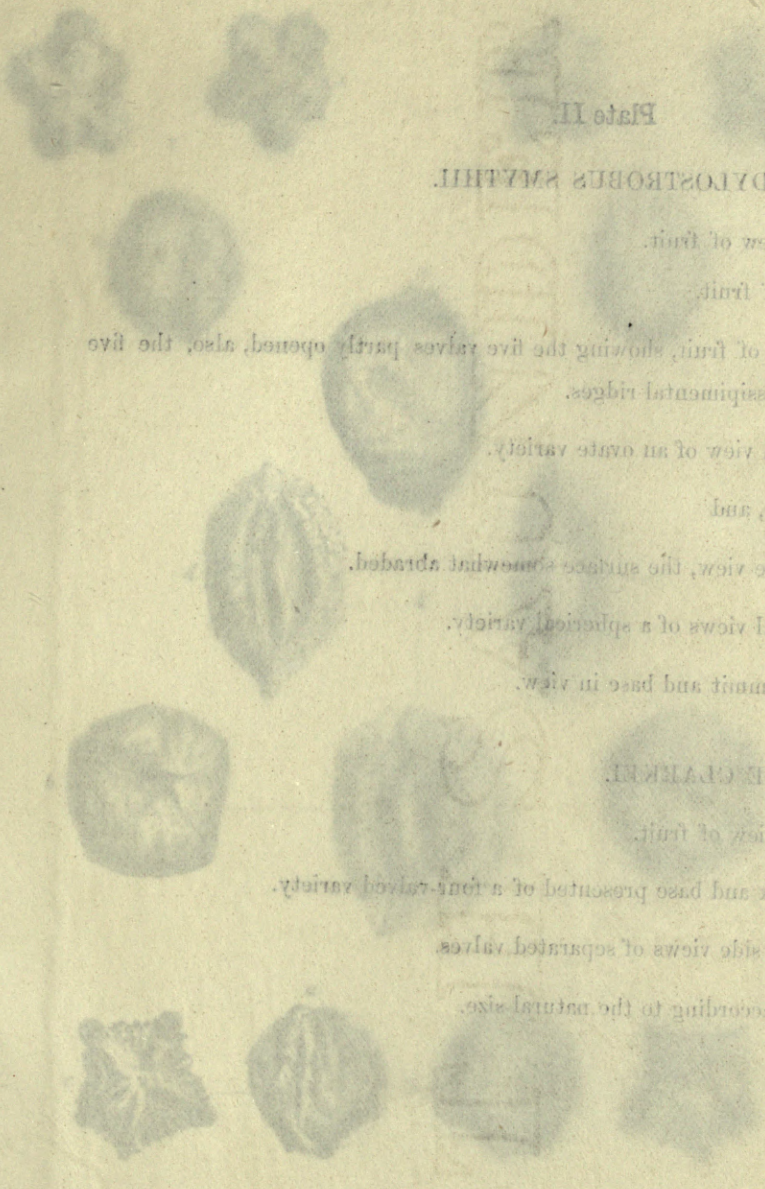

Plate II.

FIGS. 1, 2, 3, SPONDYLOSTROBUS SMYTHII.

1. *a* Side view of fruit.

b Base of fruit.

c Vertex of fruit, showing the five valves partly opened, also, the five dissipimental ridges.

Fig. 2 *a* Lateral view of an ovate variety.

b Its top, and

c Its base view, the surface somewhat abraded.

Fig. 3 *a*, *b* Lateral views of a spherical variety.

c, *d* Its summit and base in view.

FIG. 4.—PENTEUNIS CLARKEI.

a Side view of fruit.

b, *c* Vertex and base presented of a lone-valved variety.

d, *e*, *f* Inner side views of separated valves.

The figures are all drawn according to the natural size.

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FIGS. 1, 2, 3, SPONDYLOSTROBUS SMYTHII.

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b Its top, and

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Fig. 3 *a*, *b* Lateral views of a spherical variety.

c, *d* Its summit and base in view.

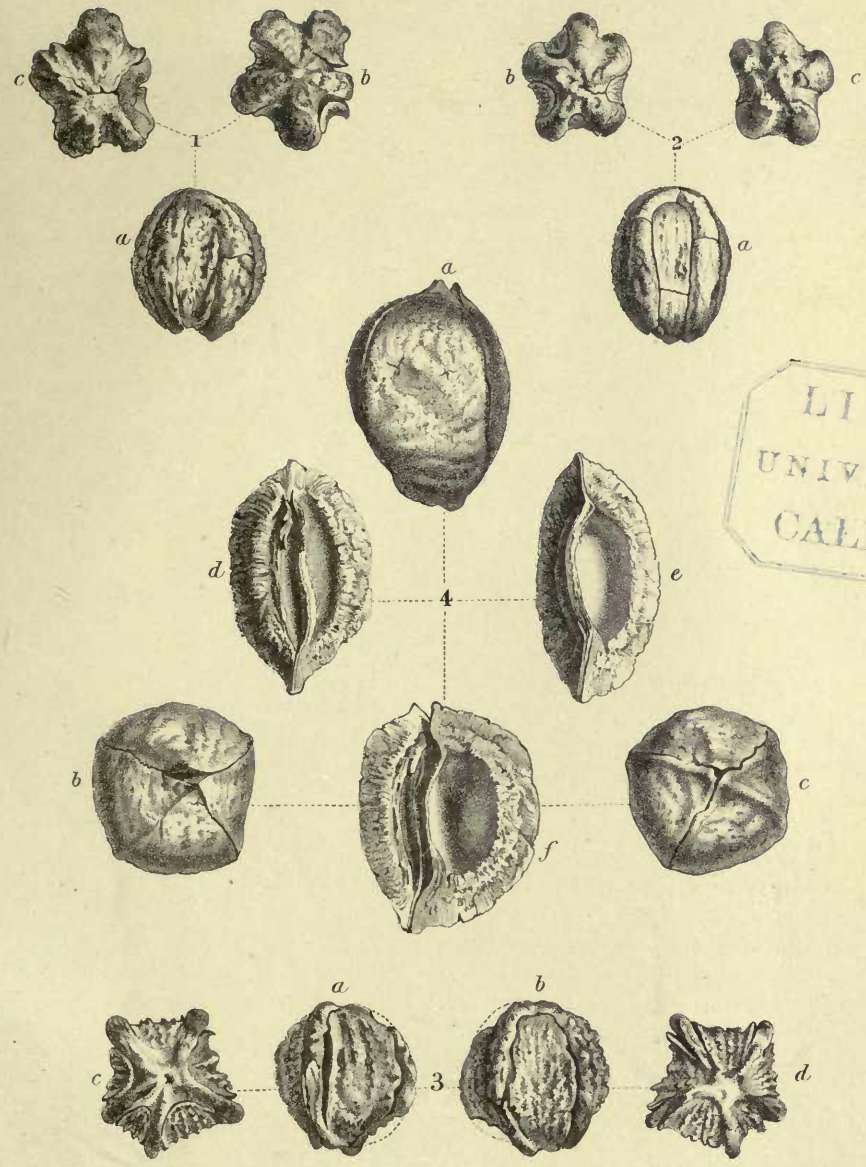
FIG. 4.—PENTEUNE CLARKEI.

a Side view of fruit.

b, *c* Vertex and base presented of a four-valved variety.

d, *e*, *f* Inner side views of separated valves.

The figures are all drawn according to the natural size.



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